

# New records of aphyllorphoroid fungi (Agaricomycetes, Basidiomycota) from the Les na Vorskle area of the Belgor'ye Nature Reserve (Belgorod Region, Russia)

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**Abstract:** Fifty-two species of aphyllorphoroid fungi have been recorded for the first time from the Belgor'ye Nature Reserve and from the Belgorod Region of Russia. An annotated list of records with data on substrate, habitat type and voucher numbers (LE, OHHI) is provided. Several rare and restrictedly distributed species in Europe are presented, viz. *Hapalopilus croceus*, *Phellinus rimosus*, *Pseudomerulius aureus*, *Sarcoporia polyspora*, and *Skeletocutis odora*. Two species, *Gloeohypochnicium analogum* and *Granulobasidium vellereum*, are proposed to be considered as indicators of biologically valuable broad-leaved forests in Eastern Europe.

**Keywords:** aphyllorphoroid fungi, biodiversity, fungal distribution, reserve, *Hapalopilus croceus*

## INTRODUCTION

Aphyllorphoroid fungi represent an artificial non-taxonomic group in *Agaricomycetes* (Hibbett et al., 2014) which unites macromycetes with diverse morphology of fruiting bodies, including polypores, corticioids, clavarioids and hydroids. These fungi implement different life strategies – from mainly saprotrophs on dead wood and litter to parasitic and ectomycorrhizal species (Kotiranta et al., 2009), and consequently they play an important role in forest ecosystems. At the same time, forest fragmentation takes place in many regions in Northern, Eastern, Central and Southern Europe (Christensen et al., 2005), and nature reserves are aimed to protect the biodiversity of different organism groups inhabiting vulnerable or unique environments.

The Les na Vorskle area is one of the oldest nature reserves in Russia. It was established in 1924 in the vicinity of the Borisovka settlement, on the northern side of Vorskla River, in the southern part of the Central Russian Upland. Nowadays, this territory is a part of the Belgor'ye Nature Reserve (see Belgorod Region in Fig. 1), and covers a square of 10.4 km<sup>2</sup>.

Les na Vorskle territory lies on the forest-steppe vegetation zone and represents an upland forest with an expressed erosive relief, with gullies and ravines. The absolute elevation is

from 135 to 217 m a. s. l. The climate in this zone is moderate continental, with a hot and prolonged summer and rather cold winter. The average temperature in January is -8.1 °C and +19.9 °C in June. Winter temperature may go down until -37 °C, while in summer it can reach up to +40 °C. Average sum of precipitation is 530 mm per year, and about half of it falls in summer. The basic soil-forming components are loess and loess-like loams. The grey forest soils are spread here (Neshataev et al., 1967).

The plant cover is composed of both natural forests, including coppice, and wood plantations. The 100–110-year old trees dominate, the



**Fig. 1.** The location of Belgorod region, Russia

oak forests that are older than 300 years occupy about 1.6 km<sup>2</sup>, but they were seriously damaged during the Second World War (Shapovalov & Arbuzova, 2005). The main forest-forming trees are *Quercus robur* (about of 80% of wood territory), *Acer platanoides*, *Tilia cordata* and *Fraxinus excelsior*. In a recent research, the increasing role of *Acer platanoides* in local communities has been shown in this area (Ryabtsev et al., 2009). Cultivated *Pinus sylvestris* forests are 100–120 years old and are characterized by rather high proportion of broadleaved species, primarily of *Tilia cordata* and *Acer platanoides*. The underwood level is formed by single individuals of *Euonymus europaea*, *E. verrucosa*, and *Acer campestre*.

The key peculiarity of the current state of plant communities is the negative zoogenic influence of wild boar, roe deer and mouse-like rodents. According to the winter counting data (Smirnov et al., 2009; Chervonny & Shchekalo, 2010), there are in average 22 individuals of boars and 25 roe deers per 1 km<sup>2</sup> what means that the litter layer and soils are pretty much destroyed. Common species of the field layer are *Aegopodium podagrarium*, *Asarum europaeum*, *Stellaria holostea*, etc.

Aphyllorhizoid fungi have never been a principal object of biodiversity studies in the Belogor'e Nature Reserve. Until now the data on species richness has been scattered in several publications devoted to inventories and ecology of fungal species (Brezhnev, 1950; Bondartsev, 1953; Bedenko, 1985; Nikolaev, 1986; Psurtseva et al., 2003). This article augments new data on aphyllorhizoid fungi of this protected area.

## MATERIAL AND METHODS

The fieldwork was carried out by the authors in August 2011 in the Belogor'e Nature Reserve (50°36'–37°N, 35°57'–59°E). Data on locality, type of forest (according to the dominant classification) and host tree was recorded for each specimen. The dried material was identified by the first author using a LOMO Micmed 6 and a Carl Zeiss AxioImager A1 light microscopes as well as the standard set of chemicals (5% KOH, Melzer's reagent, and Cotton Blue). Voucher specimens are deposited in the Mycological herbarium of the Komarov Botanical Institute of RAS, St. Petersburg (LE) and the mycological collection of

the V.N. Khitrovo Herbarium of the Orel State University, Orel (OHHI). The nomenclature of corticioids follows Bernicchia & Gorjón (2010), and that of polypores – Ryvarden & Melo (2014), respectively.

## ANNOTATED LIST OF SPECIES

- ANTRODIA HETEROMORPHA (Fr.) Donk – on fallen trunk and branches of *Acer platanoides*, oak-maple and lime-tree-birch-oak forests (LE 302192, OHHI 1295).
- AURISCALPIUM VULGARE Gray – on old cones of *Pinus sylvestris*, birch-pine forest (LE 303232).
- BOTRYOBASIDIUM INTERTEXTUM (Schwein.) Jülich & Stalpers – on fallen trunk of *Pinus sylvestris*, pine forest (LE 302167).
- BOTRYOBASIDIUM LAEVE (J. Erikss.) Parmasto – on fallen trunks and logs of *Quercus robur* and *Tilia cordata*, lime-tree-birch-oak and maple-oak forest (LE 302196, LE 303238).
- BOTRYOBASIDIUM MEDIUM J. Erikss. – on fallen trunk of *Pinus sylvestris*, pine forest (LE 303201).
- BYSSOMERULIUS CORIUM (Pers.) Parmasto – on dry log of *Tilia cordata*, maple-lime-tree-oak forest (LE 302177).
- CERIPORIA PURPUREA (Fr.) Donk – on fallen log of *Quercus robur*, maple-lime-tree-oak forest (LE 303210).
- DAEDALEOPSIS CONFRAGOSA (Bolton) J. Schröt. – on dry trunk of *Salix* sp., maple-lime-tree-oak forest (LE 302175).
- DATRONIA MOLLIS (Sommerf.) Donk – on dry trunk of *Acer platanoides*, maple-lime-tree-oak forest (LE 303202).
- DENDROTHELE ACERINA (Pers.) P.A. Lemke – on bark of *Acer platanoides*, maple-oak forest (LE 302163).
- GLOEOHYPOCHNICIUM ANALOGUM (Bourdot & Galzin) Hjortstam – on fallen trunk of *Quercus robur*, oak-maple forest (LE 302166).
- GLOEOPORUS DICHROUS (Fr.) Bres. – on fallen log of deciduous tree, maple-lime-tree-oak forest (LE 302183).
- GRANULOBASIDIUM VELLEREUM (Ellis & Cragin) Jülich – on dry log of *Corylus avellana*, maple-oak forest (LE 303229).
- HAPALOPILUS CROCEUS (Pers.) Donk – on dry trunk of *Quercus robur*, maple-oak forest (LE 302181) (Fig. 2).



**Fig. 2.** Fruiting bodies of *Hapalopilus croceus* on dry standing oak tree. Photo by D. Latkin.

- HYMENOGHAETE CINNAMOMEA (Pers.) Bres. – on fallen logs of *Quercus robur*, maple-oak forest (LE 303224, OHHI 1305).
- HYPHODERMA MUTATUM (Peck) Donk – on fallen trunks and dry logs of *Acer platanoides* and *Tilia cordata*, maple-oak and maple-lime-tree-oak forests (LE 303203, LE 303239, OHHI 1297).
- HYPHODERMA NEMORALE K.H. Larss. – on dry branch of *Tilia cordata*, maple-lime-tree-oak forest (LE 302195).
- HYPHODERMA SETIGERUM (Fr.) Donk – on fallen trunks and branches of *Acer platanoides*, *Betula pendula* and *Quercus robur*, lime-tree-birch-oak, maple-lime-tree-oak and maple-oak forests (LE 303218, LE 303243, OHHI 1304).
- HYPHODERMA TRANSIENS (Bres.) Parmasto – on dry trunk of *Acer platanoides*, maple-oak forest (LE 303226).
- INONOTUS DRYADEUS (Pers.) Murrill – on butt of *Quercus robur*, maple-oak forest (LE 302184).
- OLIGOPORUS ALNI (Niemelä & Vampola) Piątek – on fallen log of *Quercus robur*, maple-lime-tree-oak forest (LE 302164).
- OLIGOPORUS LEUCOMALLELLUS (Murrill) Gilb. & Ryvarden – on fallen trunks of *Pinus sylvestris* pine and maple-oak-pine forests (LE 302198, OHHI 1296).
- OLIGOPORUS TEPHROLEUCUS (Fr.) Gilb. & Ryvarden – on fallen logs and trunk of *Acer platanoides* and *Quercus robur*, maple-oak and maple-lime-tree-oak forest (LE 303225, LE 303245).
- OXYPORUS CORTICOLA (Fr.) Ryvarden – on fallen trunks of *Acer platanoides* and *Quercus robur* maple-oak-pine, lime-tree-birch-oak and maple-lime-tree-oak forests (LE 302178, LE 302179, OHHI 1292).
- PENIOPHORA LIMITATA (Chaillet ex Fr.) Cooke – on fallen trunk of *Tilia cordata*, lime-tree-pine forest (LE 302199).
- PENIOPHORA RUFOMARGINATA (Pers.) Bourdot & Galzin – on fallen log of *Tilia cordata*, maple-lime-tree-oak forest (LE 303216).
- PENIOPHORA VIOLACEOLIVIDA (Sommerf.) Masee – on dry branch of *Acer platanoides*, maple-oak forest (LE 303231).
- PENIOPHORELLA PRAETERMISSA (P. Karst.) K.H. Larss. – on fallen trunk of *Quercus robur*, maple-oak forest (LE 303209).
- PHANEROCHAETE LAEVIS (Fr.) J. Erikss. & Ryvarden – on fallen branches of deciduous tree, lime-tree-birch-oak forest (LE 302197).
- PHANEROCHAETE TUBERCULATA (P. Karst.) Parmasto – on fallen log of *Acer platanoides*, oak-maple forest (LE 303228).
- PELLINUS CONTIGUUS (Pers.) Pat. – on fallen trunk of *Quercus robur*, maple-oak forest (LE 302176).
- PELLINUS FERRUGINOSUS (Schröd.) Pat. – on fallen trunks of *Acer platanoides* and *Quercus robur*, maple-oak, lime-tree-birch-oak and maple-lime-tree-oak forests (LE 302185, LE 303235, OHHI 1293).
- PELLINUS RIMOSUS (Berk.) Pilát – on dry trunk of *Acer platanoides*, oak-maple forest (LE 303213).
- POLYPORUS VARIUS (Pers.) Fr. – on dry trunk of *Pyrus communis*, orchard.
- PSEUDOMERULIUS AUREUS (Fr.) Jülich – on fallen trunk of *Pinus sylvestris*, pine forest (LE 302169).
- RAMARIA ABIETINA (Pers.) Quélet – on litter, birch-pine and maple-oak-pine forests (LE 302161, LE 302162).
- SARCODONTIA CROCEA (Schwein.) Kotl. – on dry trunk of *Pyrus communis*, orchard (LE 302180).
- SARCOPORIA POLYSPORA P. Karst. – on fallen trunk of *Pinus sylvestris*, pine forest (LE 303208).
- SCHIZOPORA FLAVIPORA (Berk. & M.A. Curtis ex Cooke) Ryvarden – on fallen trunks and dry logs of *Quercus robur*, *Corylus avellana* and *Acer platanoides*, maple-lime-tree-oak and maple-oak forests (LE 302187, LE 303236, LE 303237, OHHI 1294).

- SCHIZOPORA RADULA (Pers.) Hallenb. – on fallen trunk of *Quercus robur*, maple-lime-tree-oak and maple-oak forests (LE 303212, OHHI 1299).
- SKELETOCUTIS NIVEA (Jungh.) Jean Keller – on dry and fallen branches and logs of *Acer platanoides* and *Tilia cordata*, maple-lime-tree-oak, lime-tree-birch-oak and maple-oak forests (LE 303205, LE 303240, OHHI 1298).
- SKELETOCUTIS ODORA (Sacc.) Ginns – on fallen trunk of *Pinus sylvestris*, pine forest (LE 303207).
- STECCHERINUM FIMBRIATUM (Pers.) J. Erikss. – on fallen log of *Quercus robur*, maple-lime-tree-oak forest (LE 302186).
- STECCHERINUM OCHRACEUM (Pers.) Gray – on fallen trunk of *Quercus robur*, maple-oak forest (LE 303206).
- TRAMETES HIRSUTA (Wulfen) Lloyd – on dry trunk of *Malus domestica*, orchard (LE 302193).
- TRAMETES SUAVEOLENS (L.) Fr. – on fallen trunk of *Populus tremula*, maple-lime-tree-oak forest (LE 303222).
- TRECHISPORA COHAERENS (Schwein.) Jülich & Stalpers – on fallen logs of *Quercus robur*, oak-maple and lime-tree-birch-oak forests (LE 302173, OHHI 1291).
- TRICHAPTUM FUSCOVIOLACEUM (Ehrenb.) Ryvarden – on fallen trunk of *Pinus sylvestris*, pine forest (LE 302189).
- TYROMYCES CHIONEUS (Fr.) P. Karst. – on fallen log of *Quercus robur*, maple-lime-tree-oak forest (LE 302171).
- XYLON CRUSTOSUS (Pers.) Chevall. – on fallen and dry branches of *Quercus robur* and *Tilia cordata*, maple-oak and lime-tree-birch-oak forests (LE 302182, LE 303234).
- XYLON NESPORI (Bres.) J. Erikss. & Hjortstam – on fallen trunk of *Pinus sylvestris*, pine forest (LE 303204).
- XYLON SPATHULATUS (Schr.) Kuntze – on fallen trunks of *Pinus sylvestris*, pine and lime-tree-pine forests (LE 303219, LE 303244).

## DISCUSSION

All the 52 species of aphylloroid fungi were recorded for the first time for the territory of Les na Vorskle area and the Belgorod'e Nature Reserve, as well as for the Belgorod Region. Most of the species were adapted to grow on dead wood of deciduous trees. 20 species belonged to the oak-associated aphylloroid

fungi, and 14 species were registered on maple wood. Among them, the noteworthy records of *Hapalopilus croceus* and *Phellinus rimosus* were revealed on large-dimension dry standing trunks of *Quercus robur* and *Acer platanoides*, respectively. *Hapalopilus croceus* is red-listed in three regions of Russia and 11 countries of Europe (The Global Fungal..., 2015), and is associated with old-aged oak trees, which are declining throughout Europe. *Phellinus rimosus* is known predominantly from Southern Europe, Mediterranean Region, the Caucasus, and Middle Asia (Ryvarden & Melo, 2014). Our finding in Belgorod Region expands slightly its known distribution northwards.

Attention is also paid on *Gloeohypochnicium analogum* and *Granulobasidium vellereum*, and their host and habitat requirements. The occurrence of these species also in other protected broad-leaved forests of the nemoral zone in European Russia is noteworthy. They grow on fallen trunks, logs and branches of *Acer*, *Alnus*, *Quercus*, *Tilia*, and *Ulmus* (Malysheva & Malysheva, 2008; Bolshakov & Zmitrovich, 2014; Popov & Volobuev, 2014). Therefore *Gloeohypochnicium analogum* and *Granulobasidium vellereum* are considered as indicator species of biologically valuable deciduous forests in Eastern Europe.

Ten further species were recorded on *Pinus sylvestris* in forest plantations. In addition to widespread species, mostly associated with pine, like *Auriscalpium vulgare*, *Botryobasidium medium*, and *Trichaptum fuscoviolaceum*, there were also rare or occasional species, such as *Pseudomerulius aureus*, *Sarcoporia polyspora*, and *Skeletocutis odora* (Vlasák & Kout, 2010; Ryvarden & Melo, 2014; Baldoni et al., 2015). The occurrence of these species in forest-steppe confirms the significance of the host tree in the spatial distribution of aphylloroid basidiomycetes.

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